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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/630,775	07/31/2003	Kazuya Kamon	030682-118	7888

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EXAMINER	
PIERRE LOUIS, ANDRE	
ART UNIT	**PAPER NUMBER**
2123	

DATE MAILED: 04/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/630,775	Applicant(s) KAMON, KAZUYA	
	Examiner Andre Pierre-Louis	Art Unit 2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-9 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-9 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 31 July 2003 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 7/31/03,12/20/05.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-9 have been presented for examination.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2.0 Claims 1, and 6-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. (U.S. Patent No.6, 484,300), in view of Dickenscheid et al. (U.S. patent No. 6,965,809).

2.1 In considering the independent claim 1, Kim et al. substantially teaches a simulator for a chemical mechanical polishing process for planarizing a semiconductor substrate, particularly the steps of receiving: a pattern density data containing information about a pattern density per unit region of a fabrication pattern in a pattern forming process of a semiconductor device *(fig.1-3C, col.1 line 9-col.4 line 29; also col.7 line 24-col.12 line 18);* and first and second measured data about height distributions of irregularities on said semiconductor substrate that are measured before and after a chemical mechanical polishing process executed with respect to said pattern forming process, wherein said first measured data is compared with a first calculated data about a two-dimensional distribution of irregularities on said semiconductor substrate before said chemical mechanical polishing process which is calculated from said pattern density data, a least squares analysis is performed to obtain a first correlation

coefficient, and a parameter fitting is performed such that square of said first correlation coefficient becomes a maximum, and said second measured data is compared with a second calculation data about a two-dimensional distribution of irregularities on said semiconductor substrate after said chemical mechanical polishing process which is calculated from said pattern density data, a least squares analysis is performed to obtain a second correlation coefficient, and a parameter fitting is performed such that square of said second correlation coefficient becomes a maximum (*fig.1-9 & their description, also col.1 line 9-col.4 line 29 and col.7 line 24-col.12 line 18).* Although Kim et al. shows a three-dimension simulation, and further teaches an analyze pattern density distribution module in fig.3C (350), he does not clear teach a two-dimensional distribution. Nevertheless, Dickenscheid et al. teaches a two-dimensional Gaussian distribution and further teaches parameter fitting and a comparing module (see *fig.1-9, col.1 line 15-col.4 line 62; also col.5 line 47-col.9 line 30).* It would have been obvious to one ordinary skilled in the art at the time of the applicant's invention to combine the teachings of Kim et al. with Dickenscheid et al. in order to represent the data about a two-dimensional distribution. Dickenscheid et al. further teaches the advantage of planarized surface to carry out with high-resolution subsequent exposure (*col.1 lines 14-63*).

2.2 With regards to claim 6, the combined teachings of Kim et al. and Dickenscheid et al. teach the pattern density two-dimensional distribution calculating part that receives said pattern density data, expands it in two dimensions based on a coordinate data, and outputs it as a pattern density two-dimensional distribution image;

a height distribution calculating part that obtains said first calculated data by executing n operation of multiplying a pattern density at individual parts of said pattern density two-dimensional image by a thickness of a laminated film laminated on said pattern density two-dimensional distribution image (see Kim et al. *fig.1-9 & their description, also col.1 line 9-col.4 line 29 and col.7 line 24-col.12 line 18; also Dickenscheid et al. figures & their description)*; and a CMP image calculating part that obtains said second calculated data by (i) calculating, based on said first calculated data, a two-dimensional distribution image of a polishing pad in a state that said polishing pad used in said chemical mechanical polishing process of said laminated film is pressed against said laminated film, (ii) calculating a two-dimensional distribution image of stress exerted on said polishing pad based on said two-dimensional distribution image of said polishing pad, and (iii) calculating a two-dimensional distribution image of irregularities after polishing said laminated film based on said two-dimensional distribution of said stress (see Kim et al. *fig.1-9 & their description, also col.1 line 9-col.4 line 29 and col.7 line 24-col.12 line 18; also Dickenscheid et al. figures & their description).*

2.3 As per claim 7, the combined teachings of Kim et al. and Dickenscheid et al. teach the step of receiving: a third measured data about a height distribution of irregularities of an under laid layer of said fabrication pattern which is measured before forming said fabrication pattern, and a measured data adding part that adds said third measured data to said first calculated data (see Kim et al. *fig.1-9 & their description, also col.1 line 9-col.4 line 29 and col.7 line 24-col.12 line 18; also Dickenscheid et al. figures & their description).*

2.4 As per claim 8, the combined teachings of Kim et al. and Dickenscheid et al. teach the mesh adjusting part for sampling meshes of said first and second measured data so as to match the mesh of said pattern density two-dimensional distribution image *(see Dickenscheid et al. fig.1-4, 8,9, col.5 line 47-col.9 line 30; also Kim et al. figures & their description).*

2.5 With regards to claim 9, the combined teachings of Kim et al. and Dickenscheid et al. teach the mesh adjusting part for sampling meshes of said first, second and third measured data so as to match said mesh of said pattern density two-dimensional distribution image (see *Dickenscheid et al. fig.1-9, col.1 line 15-col.4 line 62; also col.5 line 47-col.9 line 30; also Kim et al. figures & their description).*

3.0 Claims 2-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. in view of Dickenscheid et al., as applied to claims 1, and 6-9 above, and further in view of Coon et al. (U.S. Patent No. 6,988,060).

3.1 Regarding claim 2, Kim et al., as modified by Dickenscheid et al., substantially teaches most of the instant invention, and particularly teaches: a pattern density two-dimensional distribution calculating part that receives said pattern density data, expands said pattern density data in two dimensions based on a coordinate data, and outputs it as a pattern density two-dimensional distribution image (*see Kim et al. fig.1-9 & their description, also col.1 line 9-col.4 line 29 and col.7 line 24-col.12 line 18; also Dickenscheid et al. fig.1-9, col.1 line 15-col.4 line 62; also col.5 line 47-col.9 line 30)*; a first height distribution calculating part that obtains said first calculated data by executing an operation of multiplying a pattern density at individual parts of said pattern

density two-dimensional distribution image by a thickness of a laminated film laminated on said pattern density two-dimensional distribution image ((*see Kim et al. fig.1-9 & their description, also col.1 line 9-col.4 line 29 and col.7 line 24-col.12 line 18; also Dickenscheid et al. fig.1-9, col.1 line 15-col.4 line 62; also col.5 line 47-col.9 line 30)*; a spatial filter part that subjects said two-dimensional Fourier image to a spatial filter such that only a component having a predetermined spatial frequency passes through (see *fig.1-9, col.1 line 15-col.4 line 62; also col.5 line 47-col.9 line 30;* and a height distribution calculating part that obtains said second calculated data by executing an operation of multiplying a pattern density at individual parts of said two-dimensional reverse Fourier image by said thickness of said laminated film laminated on said two-dimensional reverse Fourier image (*see Dickenscheid et al. fig.1-9, col.1 line 15-col.4 line 62; also col.5 line 47-col.9 line 30; and also Kim et al. figures & their description).* However, they do not expressly teach a Fourier calculating part that performs a Fourier transform of said pattern density two-dimensional distribution image and outputs a two-dimensional Fourier image; and a reverse Fourier calculating part that subjects said two-dimensional Fourier image after being subjected to said spatial filter to a reverse Fourier transform and outputs a two-dimensional reverse Fourier image. Coon et al. substantially teaches a Fourier calculating part that performs a Fourier transform of said pattern density two-dimensional distribution image and outputs a two-dimensional Fourier image (*fig.9, 12, and 15, abstract, col.2 lines 37-67; also col.9 line 12-col.10 line 65)*; and a reverse Fourier calculating part that subjects said two-dimensional Fourier image after being subjected to said spatial filter to a reverse Fourier transform and

outputs a two-dimensional reverse Fourier image (*fig.9, 12, and 15, abstract, col.2 lines 37-67; also col.9 line 12-col.10 line 65).* It would have been obvious to one ordinary skilled in the art at the time of the applicant's invention to combine the teachings of Coon et al. with Kim et al, as modified by Dickenscheid et al., for the purpose of obtaining two-dimensional Fourier image and obtaining the inverse of the Fourier image. Coon et al. further teaches the improvement of accuracy in aligning mask and optimization *(col.1 line 42-col.2 line 67).*

3.2 Regarding claim 3, the combined teachings of Kim et al., Dickenscheid et al., and Coon et al. teach the mesh adjusting part for sampling meshes of said first and second measured data so as to match the mesh of said pattern density two-dimensional distribution image *(see Dickenscheid et al. fig.1-4, 8,9, col.5 line 47-col.9 line 30; Coon et al. and Kim et al. figures & their description).*

3.3 As per claim 4, the combine teachings of Kim et al., Dickenscheid et al. and Coon et al. teach the step of receiving: a third measured data about a height distribution of irregularities of an under laid layer of said fabrication pattern which is measured before forming said fabrication pattern, and a first and second measured data adding parts that add said third measured data to said first and second calculated data, respectively (see *Dickenscheid et al. fig.1-9, col.1 line 15-col.4 line 62; also col.5 line 47-col.9 line 30); also Coon et al. fig.9,21-22, col.9 line 12-col.16 line 52, and Kim et al. figs & their description).*

3.4 With regards to claim 5, the combine teachings of Kim et al., Dickenscheid et al. and Coon et al. teach the mesh adjusting part for sampling meshes of said first,

second and third measured data so as to match said mesh of said pattern density two-dimensional distribution image (see *Dickenscheid et al. fig.1-9, col.1 line 15-col.4 line 62; also col.5 line 47-col.9 line 30); also Coon et al. fig.9, 21-22, col.9 line 12-col.16 line 52 and col.1 line 42-col.2 line 67, and also Kim et al. figs. & their description).*

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

4.1 Neureuther et al. (USPG_PUB No. 2003/0103189) teaches a characterizing aberration in an imaging lens and applications to visual testing and integrated circuit mask analysis.

4.2 Adler et al. (USPG_PUB No. 2002/0161534) teaches a method and apparatus for inspecting a substrate.

4.3 Dai et al. (U.S. Patent No. 6,711,732) teaches a full sized scattering bar alt-psm technique for ic manufacturing in sub-resolution era.

5. Claims 1-9 are rejected and this action is non-final. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andre Pierre-Louis whose telephone number is 571-272-8636. The examiner can normally be reached on Mon-Fri, 8:00AM-4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul L. Rodriguez can be reached on 571-272-3753. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

April 12, 2006

APL

Paul L. Rodriguez 4/14/06
Primary Examiner
Art Unit ~~2125~~ 2123